Oil Shale, 2007, Vol. 24, No. 1
Pp. 5–7
ISSN 0208-189X

https://doi.org/10.3176/oil.2007.1.02

EDITOR'S PAGE

BELARUSSIAN OIL SHALE AS A PROSPECTIVE RAW MATERIAL FOR FUEL, ENERGY AND CHEMICAL INDUSTRIES – TO BE OR NOT TO BE?

The Republic of Estonia is the only country in the world where the most of electric power is being produced by burning oil shale. Thus, according to the official statistics, in the year 2003 from the total 20.4 TWh of electric and heat power produced in the country 11.0 TWh was obtained from oil shale and 0.9 TWh from shale oil. At that the existing capacities for electric power production allow, if necessary, energy export to other countries.

According to the data published by Estonian scientists and specialists (A. Raukas, J. Kann, A. Ots, J. Soone and others), oil shale reserves in the country are equal to 5 billion tonnes. Oil shale is excavated in two mines and two open pits. Oil shales are characterized by low moisture content (11–13%), high content of mineral part (60–65%), low heating value (8.3–8.5 MJ/kg) and significant chlorine content (0.75%) of the organic matter. The mineral part contains much calcium, silicon, iron, sulphur, alkali metals, other elements and compounds that create technological and environmental problems at oil shale combustion for production of electric power and heat.

The author ventured to include such an extensive introduction to the information on Belarussian oil shales in order to compare main characteristics of Estonian oil shales with those of Belarussian ones. Rocks containing kerogen (from 2–3 to 28% organic matter) in sedimentary strata of Belarus are found in the section of Brest depression (Ordovician, Silurian), Belarussian anteclise and Zhlobin saddle (Middle Devonian), Orsha depression (Upper Devonian), and in the Pripyat trough (Upper Devonian – Lower Carboniferous). Oil shales occurring within the Pripyat trough only may be of commercial importance. Oil shales in the Pripyat trough form the oil-shale basin with the total area more than 10 thousand km^2, and total possible reserves of oil shales equal about 8 780 million tonnes. Proved

reserves equal up to 1597 million tonnes within some of the prospected areas. The depth of occurrence of oil shales varies from 50 to 600 m; thickness of certain strata varies from 0.5 to 3.0 m.

Oil shales of the Pripyat trough are clayey, marly, calcareous and tuffaceous-carbonate rocks, containing from 10 to 28% organic matter. Significantly altered sapropelic material colloalginite predominates in the organic matter. Colloalginite includes single fragments of thallomealginite. Besides colloalginite and sorbocolloalginite, single components of vitrinite, fusinite, as well as fragments of yellowish-orange macrospores are present. The deposits embodying oil shales are, by the degree of katagenesis, at the low long-flame stage or at the transition from lignite to the long-flame stage.

Specific combustion heat of oil shales calculated on dry fuel varies from 4.2 to 8.4 MJ/kg (on the average within two plots from 5.33 to 6.3 MJ/kg); ash content varies from 66.4 to 77%; CO_2 content from 4.9 to 16.7% (9.9% on the average); oil yield from 6.0 to 11.1% (on the average within two plots from 7.7 to 10.2%); sulphur content reaches 2.1%.

Many institutions have been involved into the study of properties and possible means for industrial processing of Belarussian oil shales. Tallinn University of Technology is among those institutions. The results of technological investigations of two samples of oil shales are given in Table.

Table. **Yield of semi-coking products from oil shale technological samples, %**

Deposit	Oil	Semi-coke	Pyrogenetic water	Primary gas + losses
Turov	8.6	87.1	2.0	2.3
Liuban	7.4	86.6	2.7	3.2

Considering the above characteristics, oil shales from the Pripyat trough are unsuitable for direct burning and cannot be referred to as an effective solid fuel due to the high content of the mineral part, low heat value and oil yield. Nevertheless, it should be taken into account that liquid and gaseous components (pyrogenetic water, primary gas, gas naphtha) obtained at thermal treatment represent an interest as the raw material for producing a number of valuable products. Thus, phenols, ketones, volatile alkalis, and acids are being extracted at purification of tar water. Also, it is possible to obtain benzene, toluene, and solvents at pyrolysis of gas naphtha, primary gas and products of light fraction. Besides that furnace gas and mazut are being obtained in the process of pyrolysis. Oil shale semi-coke may, by its properties, be used as a raw material for producing mineral wadding and aggloporite. Oil shale ash can be used as a filler for dense and porous concrete, at production of ceramic articles (facing and refractory ceramics), as well as of binding materials (adding of 20–30% oil shale ash to concrete increases significantly its hydraulic activity). The ash may also be used in agriculture for the purposes of soil liming.

In the opinion of doctor of technical sciences P. Faliushin, about 60–100 kg of shale oil may be obtained at thermal decomposition of 1 tonne

of oil shales. From that estimation, at yearly mining of 10 million tonnes of oil shales it is possible to obtain 1 million tonnes oil fuel that would be 3–3.5% of the total consumption of fuel used to produce heat and electric power in Belarus. The calculated prime cost of high-calorific fuel (oil + gas), produced from Belarussian oil shales using gas-generating technologies, is about 350 US $ per tonne at the prime cost of oil shale mining estimated to be 19 US $ per tonne. Thus, it is possible to increase 1.5–2 times the output of liquid and gaseous fuel and, respectively, decrease the prime cost of these products while simultaneously treating oil shales and combustible waste (hydrolysis lignin, used tires). As P. Faliushin suggests, when employing an equipment burning solid heat-producing fuel, with productivity equal to 1 million tonnes per year, the output of products of oil shale thermal destruction will be: oil 52–67 thousand tonnes; gas naphtha 9.6–10.6 thousand tonnes; gas 36–58 million m^3; pyrogenetic water 21–29 thousand tonnes; and ash 740–800 thousand tonnes. Two such installations would produce enough high-quality fuel to ensure the operation of a 150 MWh power plant.

Thus, an expediency of industrial exploration of the Pripyat trough oil shales would be referred to as a justified venture only in case of oil shale processing as a complex power and technological raw material with maximum utilization of output products in different industries. Only taking into account these circumstances, it is possible to consider Belarussian oil shales a perspective raw material to be used in country's power producing and chemical industries. Nevertheless, it is most important to consider the problem of utilization of Belarussian oil shales in the context of geological, hydrogeological, environmental and economical propriety of their mining. There are serious apprehensions that these tests may form insuperable obstacles for Belarussian oil shales.

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